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Melothria pendula L. (Cucurbitaceae): first report from Java and range extension in Sumatra, Indonesia

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Abstract. *Melothria* L. (Cucurbitaceae) is a Neotropical genus of wild cucumber comprising 12 species. The only species that occurs in Malesia is *M. pendula* L., which has been recorded in Peninsular Malaysia, Borneo, mainland Sumatra, the Philippines, Sulawesi, and Bali. During our botanical excursions in Bangka and West Java from 2020 to 2022, we discovered naturalized populations of *M. pendula*. Our findings reveal that *M. pendula* has an extensive distribution in Sumatra and is a newly recorded wild cucumber in Java. We present a morphological description, photographs, and a brief discussion.

Key words. Alien plant, Benincaseae, Malesia, naturalized, wild cucumber

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Introduction

Cucurbitaceae is comprised of 101 genera distributed all over the world, particularly in the tropics (de Wilde and Duyfjes 2010; Kubitzki 2011). Malesia has 29 native and 10 cultivated genera, with the cultivated genera having some species becoming naturalized, for example, *Citrullus* Schrad. ex Eckl. & Zeyh., *Cucurbita* L., and *Sicyos* L. (de Wilde and Duyfjes 2010). The taxonomical data on the Cucurbitaceae of Java was considered complete since the publications of by Backer and Bakhuizen van den Brink 1963 and de Wilde and Duyfjes 2010. As many as 27 genera and 50 species are found on the island of Java, and 11 species are introduced plants, such as those belonging to the genera *Cucumis* L., *Cyclanthera* Schrad., *Lagenaria* Ser., and *Luffa* Mill. (Backer and Bakhuizen van den Brink 1963; de Wilde and Duyfjes 2010; Schaefer and Renner 2011).

The genus *Melothria* L. is a native to the New World, and 12 species have been described (de Wilde and Duyfjes 2006, 2010). The genus is a monoecious climber, with male flowers in a pedunculate-raceme inflorescence, a yellow corolla with a notched apex, and three stamens inserted in or near the throat of the receptacle tube (de Wilde and Duyfjes 2006, 2010). *Melothria* is closely related to the genus *Indomelothria* W.J.de Wilde & Duyfjes, which is native to Asia and Malesia (Schaefer and Renner 2011). The corolla of *Indomelothria* is often white or creamy white and has an obtuse apex (de Wilde and Duyfjes 2006, 2010). These characteristics have important in distinguishing these two genera.

Melothria pendula L. is the only species of its genus that occurs in Malesia, where it has been introduced. It is now naturalized in Peninsular Malaysia, mainland Sumatra, Borneo (Sabah), the Philippines, Sulawesi, and the Lesser Sunda Islands (Bali) (de Wilde and Duyfjes 2006, 2010; Mustaqim and Putra 2020). Furthermore, this species has also been discovered in southeastern China (POWO 2024) and Taiwan (Hsu et al. 2001; Wu et al. 2010). During our botanical expedition from 2020 to 2022, we discovered naturalized populations of *M. pendula* on Bangka Island (Sumatra) and Bogor (West Java). The species is common in urban areas and grows spontaneously along roadsides, in gardens, open spaces, and ditches, in burial grounds and abandoned land. These specimens represent the first record for Java. We show that *M. pendula* has a wide range in Sumatra, although previously it has been reported only from North Sumatra (Mustaqim and Putra 2020). As a result, we consider *M. pendula* to be a new alien species for floras of Java and of Bangka Belitung Islands. We include a morphological description, photographs, and a brief discussion of *M. pendula*.

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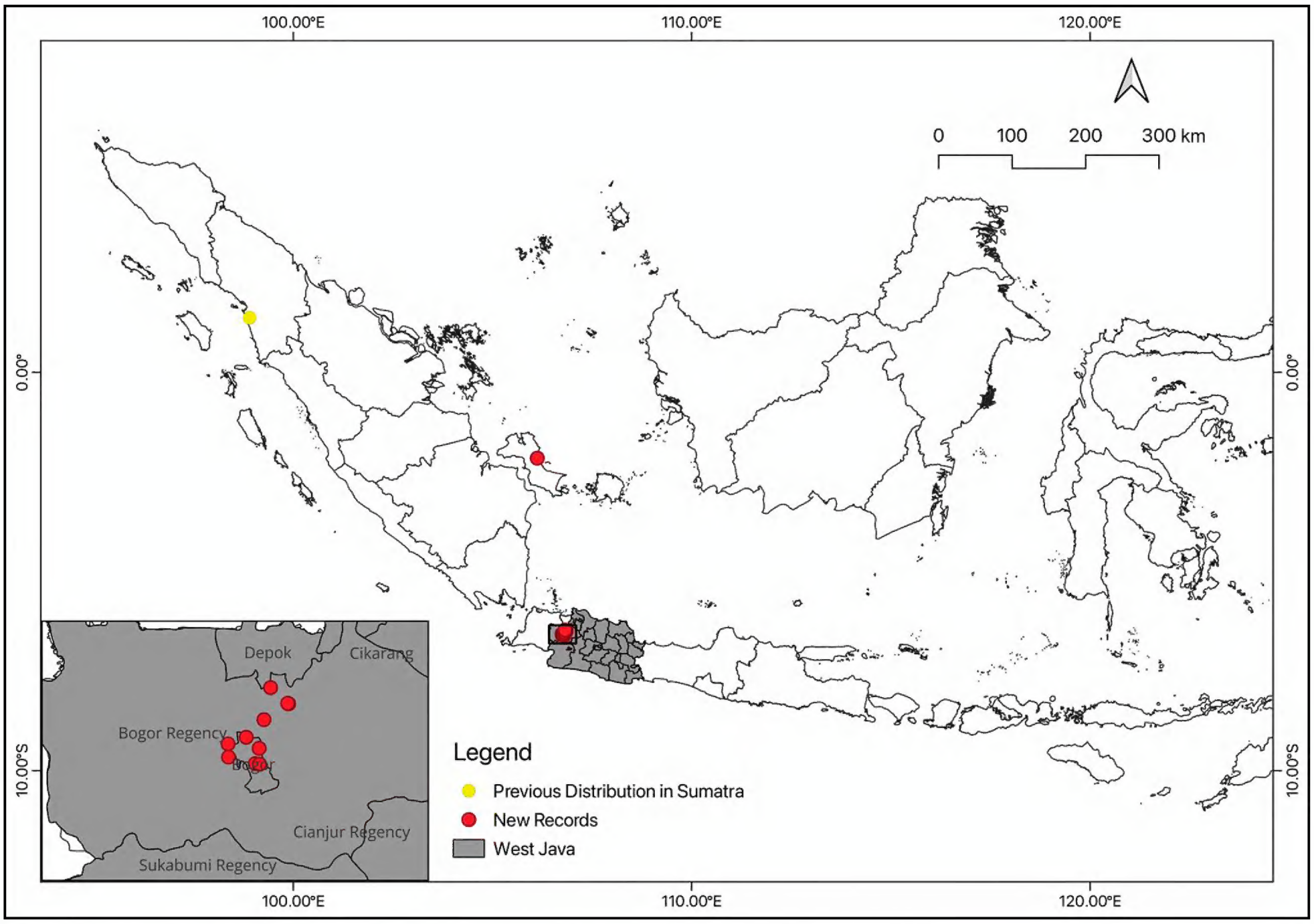

Figure 1. Maps of Central Bangka and Bogor with distributions of the observed wild population of *Melothria pendula*.

METHODS

The research was conducted using the exploration method in Bangka Island (Pangkal Pinang City) and West Java (Bandung City, Bandung Regency, Bandung Barat Regency, Bogor City, Bogor Regency, Pangandaran Regency, Sukabumi Regency, and Sumedang Regency) from 2020 to 2022 (Figure 1). Morphological observations and specimen preservation were performed at Herbarium Bandungense (**FIPIA**), School of Life Sciences and Technology, Institut Teknologi Bandung. Hsu et al. (2001), de Wilde and Duyfjes (2006, 2010), Kubitzki (2011), and Mustaqim and Putra (2020) were used to identify the specimens. The terminology used in the description follows Beentje (2016).

We also examined specimens deposited at Herbarium Bogoriense (**BO**), the National Research and Innovation Agency, to confirm the identity of plant materials collected in the field. The lectotype specimen of *M. pendula* (*Herb. LINN No. 51.1*) has been examined digitally on JSTOR Global Plants (https://plants.jstor.org/). Morphological data were observed and photographed under a Dino-Lite 5MP Edge AM7915MZT (Dino-Lite, Singapore). ArcGIS v. 10.8 was used to create the map. The 2020 district/city administrative border map was acquired from the Geoportal Geospatial Information Agency website (https://geoportal.big.go.id/).

RESULTS

Melothria pendula L.

Figure 2

New records. INDONESIA, SUMATRA – **Bangka Belitung Islands** • Pangkal Pinang City, Pangkalan Baru Subdistrict, Dul, Jl. Girimaya 1; 02°09′10.2″S, 106°07′15.8″E; 26 m a.s.l.; 23.X.2020; collection number 111; FIPIA. JAVA – **West Java** • Bogor Regency, Cibinong Subdistrict, Pondok Rajeg Village, Pondok Rajeg Cemetery Complex, Jl. Kp. Pd. Rajeg No. 13; 06°27′53.4″S, 106°49′12.0″E; 124 m a.s.l.; 27.XI.2021; collection number 665; FIPIA • Bogor Regency, Dramaga Subdistrict, Jl. Raya Ciherang; 06°35′13.6″S, 106°44′45.1″E; 201 m a.s.l.; 10.VII.2022; collection number 315; FIPIA • Bogor Regency, Cibinong Subdistrict, Cibinong Science

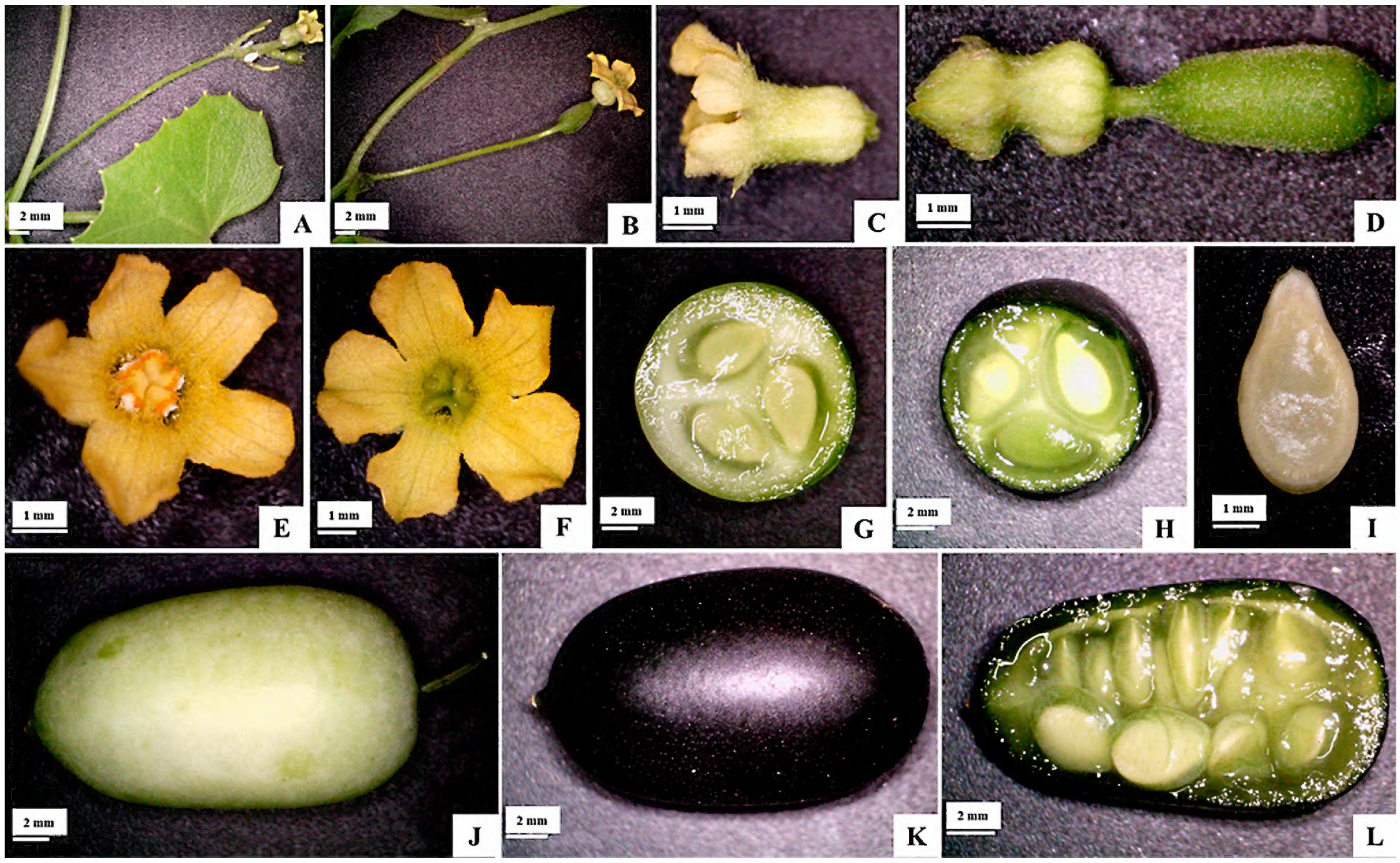

Figure 2. *Melothria pendula* L. **A.** male inflorescense attachment posisition. **B.** female flower attachment position. **C.** lateral view of male flower. **D.** lateral view of female flower. **E.** frontal view of male flower. **F.** frontal view of female flower. **G.** transversal section of unripe fruit. **H.** transversal section of ripe fruit. **I.** seed. **J.** unripe fruit. **K.** ripe fruit. **L.** longitudinal section of ripe fruit. Each figure was observed using different magnification and scale.

Center Complex, Jl. Raya Jakarta–Bogor Km 46, Cibinong Botanic Gardens; 06°29′35.2″S, 106°51′06.2″E; 138 m a.s.l.; 18.X.2022; collection number 317; FIPIA • Bogor Regency, Cibinong Subdistrict, Cibinong Science Center Complex, Jl. Raya Jakarta–Bogor Km 46, Herbarium Bogoriense, in front of the administration building; 06°29′35.8″S, 106°51′03.1″E; 140 m a.s.l.; 18.X.2022; collection number 318; FIPIA • Bogor Regency, Cibinong Subdistrict, Cibinong Science Center Complex, Jl. Raya Jakarta–Bogor Km 46, Indonesian Culture Collection (InaCC) building; 06°29′32.4″S, 106°51′00.1″E; 135 m a.s.l.; 18.X.2022; collection number 319; FIPIA • Bogor Regency, Cibinong Subdistrict, Karadenan, Jl. Raya Karadenan Gg. H. Mantik; 06°31′16.2″S, 106°48′29.9″E; 160 m a.s.l.; 10.V.2022; collection number 320; FIPIA • Bogor City, Bogor Botanic Gardens, Jl. Otto Iskandardinata No. 3, Paledang; 06°35′58.2″S, 106°48′01.3″E ; 245 m a.s.l.; 18.X.2022; collection number 271; FIPIA • Bogor City, Nusagrow Farm, Jl. Batu Hulung, RT.01/RW.02, Balungbangjaya; 06°33′49.8″S, 106°44′42.1″E; 185 m a.s.l.; 12.III.2023; collection number 313; FIPIA • Bogor City, Central Bogor, Jl. Kantor Batu No. 31, Paledang, Kantin Garasi; 06°35′55.0″S, 106°47′34.5″E; 255 m a.s.l.; 22.IX.2022; collection number 297; FIPIA • Bogor City, Tanah Sareal, Jl. Merak 6-4; 06°34′17.7″S, 106°47′59.1″E; 217 m a.s.l.; 22.XI.2022; collection number 300; FIPIA • Bogor City, Universitas Nusa Bangsa, Jl. Sholeh Iskandar Km 4, Tanah Sareal; 06°33′07.8″S, 106°46′37.5″E; 182 m a.s.l.; 12.III.2023; collection number 347; FIPIA.

Identification. Herb, monoecious. Stems slender, setulose to glabrous, diameter up to 1.5 mm, green; tendrils slender, unbranched, 5.5–10.5 cm long, hairy, yellowish green; probracts absent. Leaves alternate; petiole slender, hispid, 6–30 mm; lamina ovate to ovate-hastate, unlobed or shallowly to deeply 3–5-lobed, 1.5-7 × 1–7 cm, base deeply cordate, margin denticulate to dentate or shallowly undulate, apex obtuse to acuminate, apiculate, palmate, veins 7–8, prominent, membranous to herbaceous, adaxially dark green, abaxially pale green, hispid to scabrid on both surfaces. Male flowers 2–4 in axillary fascicles, often with an accompanying solitary flower; peduncle slender, 1 cm long; pedicels slender, up to 5 mm long; calyx campanulate, c. 0.5 mm long, pubescent to glabrous; corolla connate, 5-lobed, lobes obovate-oblong, 3 × 3 mm, apex truncate to retuse, yellow; stamens 3, two 2-celled, one 1-celled; filaments short, ca. 0.5 mm long; anthers ellipsoid. Female flower solitary, axillary; pedicel slender, c. 15 mm long; calyx and corolla as in male flowers; ovary c. 5 mm long, green; style c. 1 mm long, yellowish green; stigma 3-lobed, c. 1.5 mm long, yellowish green. Fruits pepo, pedicel up to 40 mm long, pendulous, subglobose to ellipsoid, 13–15 × 8–11 mm, black when ripe. Seeds pallid, ovate, compressed, 3–5 × 1.5–3 mm, 0.5 mm thick, minutely fimbriate, yellowish white.

Distribution. This species is naturally found in the central and eastern United States, as well as in Tropical America. In Malesia, *M. pendula* was introduced to Peninsular Malaysia, Borneo, mainland Sumatra, the Philippines, Sulawesi, and Bali (de Wilde and Duyfjes 2010; Mustaqim and Putra 2020; POWO 2024).

Ecology. *Melothria pendula* grows along roadsides and in gardens, open areas, ditches, cemeteries, and abandoned land in our study areas, at 26 m a.s.l. in Pangkal Pinang City and 124–255 m a.s.l. in Bogor City and Bogor Regency.

DISCUSSION

Melothria is a newly recorded genus of naturalized cucumber in Java. It is represented in Java by a single species, *M. pendula*. Taxonomically, the genus is belongs to the tribe Benincaseae Ser. (Schaefer and Renner 2011; de Boer et al. 2015). The tribe comprises dioecious or monoecious climbers with simple or 3–7-lobed leaves, yellow, orange, salmon, or white flowers, three stamens (two anthers 2-thecous, one 1-thecous, less often all 2-thecous or all 1-thecous), and indehiscent fruits (Schaefer and Renner 2011). According to the previous studies, the tribe consists of 11 genera in Java, namely *Benincasa* Savi, *Citrullus*, *Coccinia* Wight & Arn., *Cucumis*, *Diplocyclos* (Endl.) Post & Kuntze, *Indomelothria*, *Lagenaria*, *Muellerargia* Cogn., *Mukia* Arn., *Solena* Lour., and *Zehneria* Endl. [including *Neoachmandra* W.J.de Wilde & Duyfjes, and *Pilogyne* Eckl. ex Schrad.] (de Wilde and Duyfjes 2010; Schaefer and Renner 2011; de Boer et al. 2015). As a result of our discovery, the number of species of Benincaseae in Java has increased to 12 genera.

In Bogor, naturalized *M. pendula* were also collected from Bogor Botanic Gardens and Cibinong Botanic Gardens, National Research and Innovation Agency (Figure 3). *Melothria pendula* spontaneously grows as a non-collection species. It was first seen at Bogor Botanic Gardens during the COVID-19 pandemic and was collected for the first time from block III.G, which contained Icacinaceae and Rutaceae plant collections. The population seems to be spontaneously growing, twinning on the living collections and covering some ground in block IV. A (Apocynaceae) and IV.E (Rubiaceae). *Melothria pendula* grows in open areas of the botanic gardens. Furthermore, its spontaneous population is found twinning on the fence of the Cibinong Botanic Gardens and some of other fences in the area, such as in front of the Herbarium Bogoriense and Indonesian Culture Collection building.

Melothria pendula only occurs in lowland areas in its native geographic range. It has become naturalized in Malesia and Taiwan (Hsu et al. 2001; Wu et al. 2004; de Wilde and Duyfjes 2006, 2010; Mustaqim and Putra 2020). We discovered this species in Pangkal Pinang City, Bangka Island, in 2020. It does not appear to be common in this area because the plant is not cultivated in gardens. This wild cucumber may have adapted and established a wild population in other provinces and small islands of Sumatra, although its presence on the smaller Sumatran islands has never been documented. Research on alien plants on

Figure 3. Locations of naturalized *Melothria pendula*. **A.** Twinning in front of Kantin Garasi (Bogor City). **B.** Twinning on the fence of Cibinong Botanic Gardens. **C.** Climbing on a tree trunk in Pondok Rajeg Cemetery (Cibinong). **D.** Growing in the ditch beneath houses in Karadenan (Cibinong).

Sumatra's adjacent islands is still lacking, and naturalized plant species of Sumatra are undersampled (Mustaqim and Putra 2020).

The history of the introduction of *M. pendula* to Bangka Island and Java is in dispute. *Melothria pendula* seems to have been introduced for horticultural purposes and has accidentally escaped from cultivation. According to our observations, the species reproduces generatively in nature and produces fruit with numerous seeds. The naturalized cucumbers, for example *Cucurbita moschata* Duchesne and *Sicyos angulatus* L., spread mainly by re-seeding themselves (Juan et al. 2023; Mikeladze and Bolkvadze 2023). Birds or small mammals are crucial seed dispersers in Cucurbitaceous plants (Kubitzki 2011; Mikeladze and Bolkvadze 2023), and animals may consume the ripe fruit of *M. pendula*, which is blackish purple. At the Bogor Botanic Gardens, we observed that ants feed on the seeds because of their pleasant flavor and aroma. Ripe fruit is reportedly edible and consumed by humans (Kubitzki 2011; Piedra-Malagón et al. 2022). We discovered an unusual root in the node of a climbing stem, which enigmatically appears to be sustaining the stem's ability to grow and ascend the host plant or building.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: ASDI, MRH. Data curation: ASDI, MRH, IPAH, AHW, SS, PY. Investigation: ASDI, MRH, IPAH, AHW, SS, PY, DL. Methodology: ASDI, MRH. Supervision: DR. Visualization: MRH, IPAH. = Validation: ASDI. Writing – original draft: ASDI, MRH, IPAH, DL. Writing – review and editing: ASDI, MRH.

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Data availability

All data that support the findings of this study are available in the main text.

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